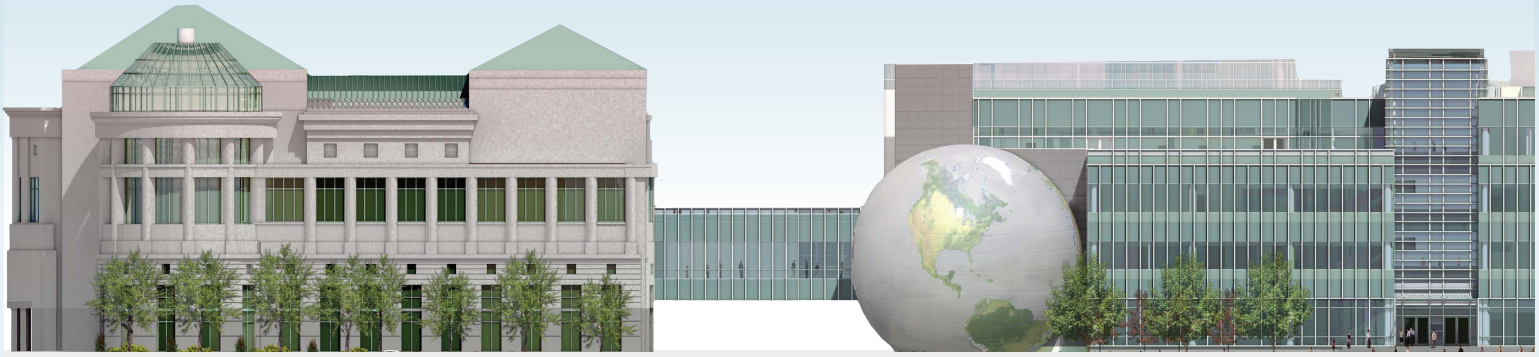
NATURESEARCH
NEWSLETTER



Issue 03
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The Foundations of the Museum: Collections and Research

There is a distinction between science museums and science centers. Both play increasingly significant roles in life-long education, bringing science to the community in unique and exciting ways. Museums are distinct, however, in that they typically house and maintain scientific collections of biological, paleontological, geological, and /or archaeological specimens. The NC Museum of Natural Sciences, for example, is responsible for the care and growth of our State's natural sciences collections, which currently include more than three million specimens! Because of this mandate, the staff of museums usually includes scientists who conduct research on those specimens. We are pleased to announce that our "research family" is recently expanded with the arrivals of Dr. Emlyn Koster and Dr. Patrick Treuthardt.

Dr. Koster, our new Museum Director, comes to NC from a distinguished career in the museum world, including previous directorships of the Royal Tyrrell Museum of Paleontology, the Ontario Science Centre, and the Liberty Science Center. With a research background in geology, Dr. Koster has an extensive publication record not only on his geological research, but also in informal science education and in the roles of science museums in modern society. Dr. Treuthardt, the new Assistant Director of our Astronomy & Space Observation Laboratory, is an astronomer and an expert on dark matter. Welcome to both Emlyn and Patrick!

Research drives so much of what our Museum offers to the public. Visitor numbers continue to exceed expectations, and we are always expanding our educational programs to bring science to the community. Presentations by Museum scientists in the SECU Daily Planet theater engage and inspire visitors of all ages, and our Thursday night "Science Cafes" attract standing-room only audiences. We recently hosted our first-ever academic symposium, highlighting research on invertebrates of the Southeastern United States while simultaneously honoring the more than 40 years of service of our Curator of Terrestrial Invertebrates, Dr. Rowland Shelley. The list goes on and on. We are proud of our active and vibrant research staff, and invite you to visit the Museum and interact with us!

Enjoy science!

Meg Lowman, Ph.D.
Director,
Nature Research Center

Jason Cryan, Ph.D
Deputy Museum Director
for Research & Collections

Current Research Briefs

Small Mammal Diversity of the Prairie Ridge Ecostation

Lisa Gatens, *Research Curator, Mammalogy*
Ben Hess, *Collections Manager, Mammalogy*

Prairie Ridge Ecostation is the NC Museum of Natural Science's environmental education and research station, located off of Reedy Creek Road in west Raleigh. The site features 38 acres of restored prairie, lowland forest, and wetlands, through which several hiking trails intersect. The management focus of Prairie Ridge is to convert what was once pasture for dairy cows to native Piedmont Prairie and to maintain a bottomland arboretum of native North Carolina tree species. These habitats are maintained by several ecological management practices, including mowing and prescribed burn rotations. In planned environments such as Prairie Ridge, it is essential to characterize and track the various ecosystem components in order to inform effective management strategies. In that effort, Lisa Gatens and Benjamin Hess (the Museum's Mammalogy Unit) are conducting a long-term mark-recapture study on the native small mammals of Prairie Ridge. In their study, begun during the summer of 2011, the Mammalogy team conducts four week-long trapping events each year with a total of seven trapping sessions so far. Traps are set in three distinct field types (forested bottom, fescue field, and Piedmont prairie). During each trapping session, 50 live-traps are laid out in a 5×10 grid with 10 meters distance between traps; the traps are set on Monday evening and checked early every morning throughout the trapping week. Because it is important to process each capture as efficiently as possible, Lisa and Benjamin rely on good volunteer help. Since the beginning of this project the team has been assisted by two technicians, four interns, three volunteers from other sections of the Museum, two volunteers from other State agencies, and no fewer than 26 college and high school students. Every small mammal captured is identified to species, given a uniquely numbered ear tag, and processed for a variety of data parameters (including age, sex, reproductive condition, weight, external measurements, and any additional observations on general health and condition of the individual) before being released. Those data are correlated with seasonality, physical distribution (i.e., where the individual animals are captured within Prairie Ridge), and precise weather data (a State Climate Office weather station is located nearby Prairie Ridge). Specimen records from the Museum's Mammalogy Research Collection, and information from the published scientific literature, suggest that Wake County historically had a rich small mammal fauna. Unfortunately, little remains of the early natural areas, and now field habitats and wooded areas exist in fragments throughout the Piedmont. The species captured thus far include white-footed mouse (*Peromyscus leucopus*), harvest mouse (*Reithrodontomys humulis*), house mouse (*Mus musculus*), southern short-tailed shrew (*Blarina carolinensis*), with the vast majority of the captures being hispid cotton rat (*Sigmodon hispidus*). This ongoing project will provide information on how the small mammal fauna of the region

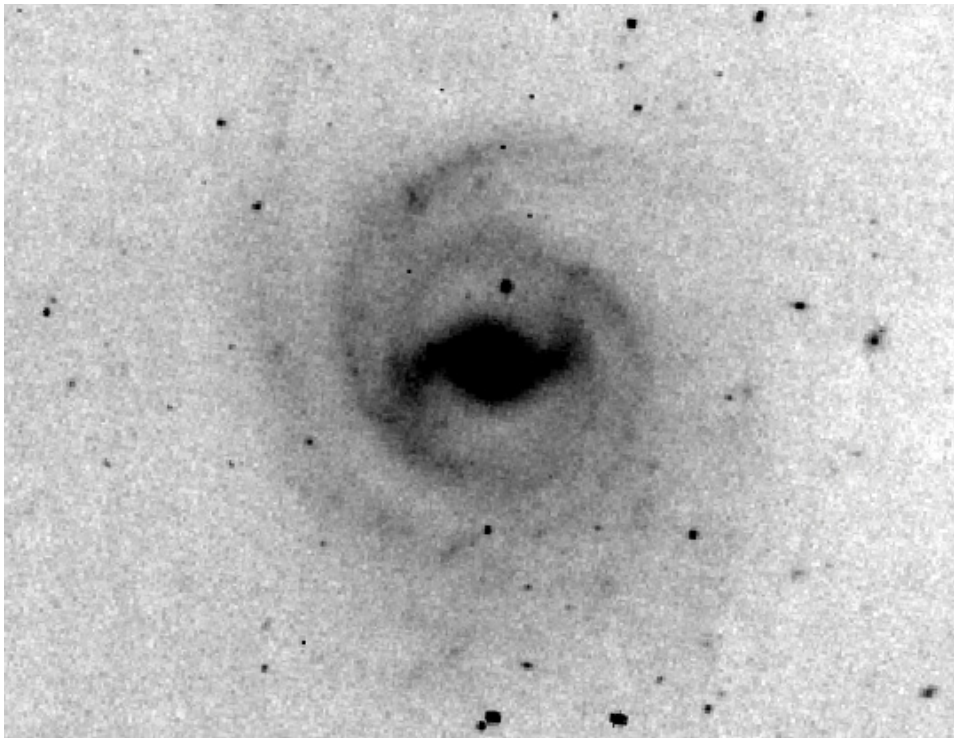
Current Research Briefs *continued*

has changed over time in response to this dramatic habitat alteration. And, with the kinds of information collected during this project, much is to be learned about the basic biology and behavior of the region's small mammals. How do native small mammal populations fluctuate seasonally or annually? How does local weather impact reproductive cycles and activity patterns? Do different small mammal species use habitat types differently? The answers to these questions, and others, will help inform more effective ecosystem management strategies.

A Spiral Galaxy with a Twist

Patrick Treuthardt, Ph.D., *Assistant Director, Astronomy and Space Observation Research Laboratory*

What are the dynamical processes involved in producing some of the spectacular galaxies we see in the Universe? How do the morphology and dynamics of a galaxy connect with the supermassive black hole harbored in its nucleus or the enormous halo of dark matter the galaxy resides in? These questions have been the focus of Dr. Patrick Treuthardt's recent work. Treuthardt has been investigating a highly unusual disk galaxy (named NGC 3124) with a stellar spiral pattern in its central region that appears to be counter-winding relative to the more expansive outer spiral structure. Treuthardt has gathered various high resolution multi-wavelength images that highlight different components of the galaxy such as the light absorbing dust; young, hot star forming regions; and older, cooler stellar backbone of the galaxy. These images show that while the stars in the central region appear as a counter-winding spiral pattern, the dust found in the same region is not counter-winding. A 2D gas velocity map of the galaxy also shows that the hydrogen in galaxy's central region



NGC 3124: A galaxy with a stellar inner spiral that is counter-winding relative to the outer-spiral structure

is both not counter-winding or counter-rotating. Treuthardt has gone on to produce dynamical simulation models of the galaxy in an attempt to recreate both the outer and strange inner counter-winding stellar spiral. When left to naturally evolve in the computer simulation, the models produced a similar, yet short-lived, inner counter-winding spiral. This seems to be due to a temporary "bunching" of stars in their orbits around the galaxy's center which in turn creates the appearance of a counter-winding spiral. The transient nature of this phenomenon is the likely reason why it has not been observed in any other galaxy thus far. In the near future, Treuthardt hopes to measure the velocities of the stars that make up this counter-winding spiral using one of the 8.2-meter telescopes of the Very Large Telescope on Cerro Paranal in Chile. These measurements will likely confirm the models' predictions and show that the stars' orbits are not unusual.

Big Bird?

Lindsay Zanno, Ph.D., *Director of the Paleontology and Geology Research Lab and Research Assistant Professor, Department of Biology, North Carolina State University*

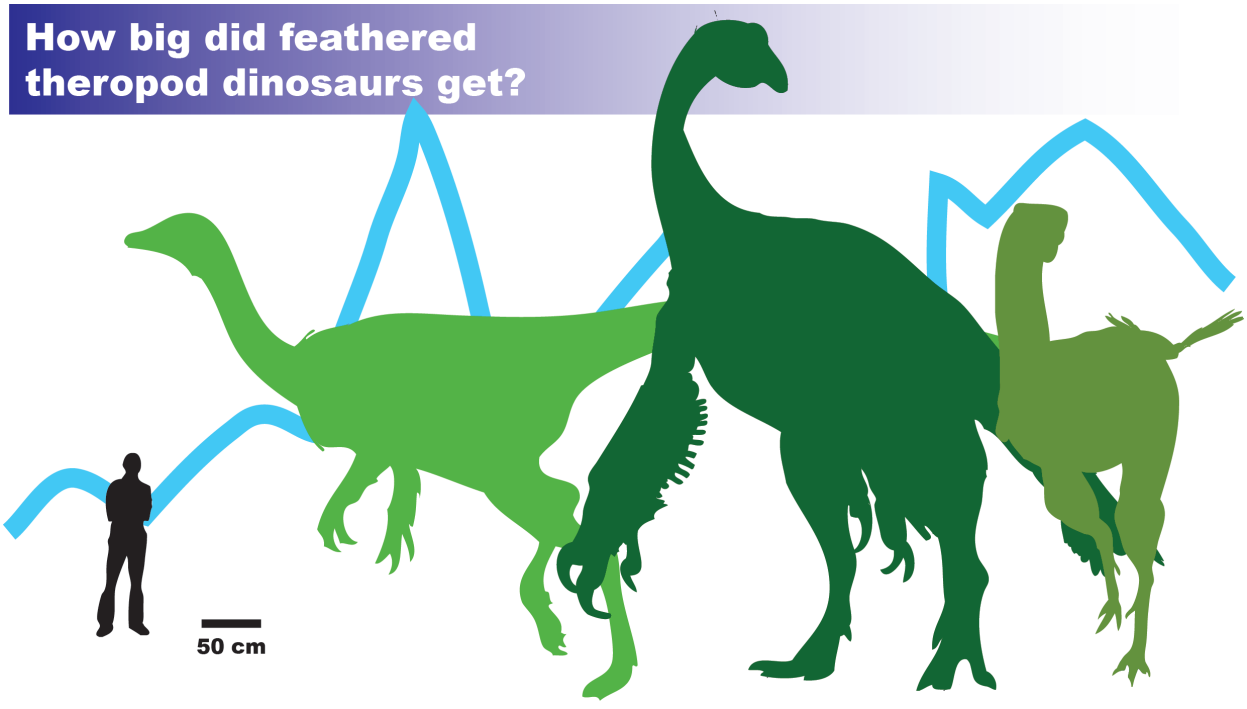
The largest living dinosaur on earth is the ostrich (*Struthio camelus*) — a flightless African bird weighing in at a whopping 200-300 lbs. Sound impressive? It might, until you consider this: new research by Dr. Lindsay Zanno and colleague Dr. Peter Makovicky of The Field Museum finds that the largest extinct feathered dinosaurs,

Current Research Briefs *continued*

which roamed the planet back in the Cretaceous, repeatedly topped the scales at over 13,000 lbs — larger than a full-grown male African elephant. Drs. Zanno and Makovicky wondered what propelled feathered dinosaurs to evolve gigantic proportions, especially when they observed that the largest feathered dinosaurs were also those thought to have eaten plants rather than hunting prey.

Scientists have long considered larger body size to be advantageous to vegetarian animals. Larger guts can fit larger digestive tracts allowing animals to get more energy from low quality food. Might the evolution of gigantism and vegetarianism go hand-and-hand in this group? To test this hypothesis, Zanno and Makovicky fitted a variety of evolutionary models to their data. The researchers discovered that feathered dinosaurs experimented with both larger and smaller body sizes as they evolved and there was no clear drive to get big, no simple, overwhelming advantage to reach gigantic proportions. Another pattern emerged from the research; different species from the same time and place tended to be about the same relative size, suggesting that changing environments during the evolution of these animals played a more important role in body size evolution than did their diet. Variation in climate, range size, and resource abundance all exerted a stronger influence on the evolution of size than the simple relationship between eating plants and being big. For feathered dinosaurs, bigger isn't always better. [Article link: http://rspb.royalsocietypublishing.org/content/280/1751/20122526.short]

Hand claws of *Therizinosaurus*, one of the largest feathered dinosaurs, topping the scales at over 13,000 lbs. *Therizinosaurus* lived in what is now Mongolia just before the mass extinction event at the end of the Cretaceous



Meet the Museum Scientists

Daniel S. Dombrowski, M.S., D.V.M.

Dr. Dombrowski is currently the Chief Veterinarian at the North Carolina Museum of Natural Sciences and an Adjunct Faculty at the North Carolina State University College of Veterinary Medicine. Dan leads the Veterinary Services Unit at the "Window on Animal Health" facility in the Nature Research Center, responsible for the maintenance of the Museum's Living Collection of more than 2000 live animals (including both vertebrates and invertebrates). Dan's research interests include the natural history, wildlife health, and veterinary medicine of bizarre and unusual species. He is particularly interested in Amphibian Chytrid Fungus (*Batrachochytrium dendrobatidis*) and Amphibian Ranavirus. He earned his Bachelor's and Master's Degrees in Biology from Virginia Commonwealth University, where he studied oviposition and host plant selection in swallowtail butterflies. Dan was the Curator of the Conservatory and Tropical Education at the NC Museum from 1998 to 2001, and then attended the NCSU Vet School (2002-2006), earning his D.V.M. and received the Wildlife, Avian, Aquatic, and Zoological Medicine (WAAZM) Proficiency in Zoological Medicine Award upon graduation. Dan has authored/co-authored several academic publications in pharmacology, natural history, and clinical veterinary medicine, as well as two book chapters on invertebrate medicine. He now focuses most of his attention on science education and sharing his Museum Medicine experience with visitors and other folks of all ages and backgrounds.

John Gerwin

John Gerwin, Research Curator of Ornithology, oversees the Museum's Ornithology Unit and is responsible for the bird Research Collection, which currently holds more than 25,000 bird study skins, eggs, nests, and skeletal specimens. John's research focuses on the life cycles of migratory birds; specifically, he studies the breeding biology of painted buntings and Swainson's warblers in North and South Carolina, yellow-bellied sapsuckers, and black-throated green warblers in NC, as well as non-breeding golden-winged warblers in Nicaragua. John primarily uses radio telemetry to study how birds use their habitats, and is involved in collaborative projects looking at genetic markers and stable isotope chemistries in various species. He also is a member of a "working group" to assess the breeding status and conservation needs of the black-capped petrel on the island of Hispaniola. John is the current Chairperson for the Scientific Council on Rare, Threatened, and Endangered Birds of NC and serves on the boards and/or technical committees of several ornithological groups (including the Wake Audubon Society Board, the Greater Uwharries Conservation Partnership, Audubon NC, Important Bird Areas, NC Partners In Flight, and the Piedmont subgroup of the NC Birding Trail). John is heavily involved in public programming and leads ecotours to local, national, and international destinations; for example, he has lead birding groups on trips to northern Nicaragua since 2005. John has worked at the Museum for 24 years. He received a B.S. (Biology) from the University of Minnesota, and M.S. (Zoology) from Louisiana State University. John's interest in birds began at a young age, when his oldest sister helped him learn 10 local birds; the rest is (natural) history!

Brian Malow

As Curator of the SECU Daily Planet, Brian Malow's role is to help communicate science to the public in an engaging way. He emcees live presentations at the Museum, interviews scientists on stage, and hosts the Museum's weekly Science Cafés. Malow came to the Museum with a nontraditional background: two decades as a stand-up comedian. Carving out a niche as "Earth's Premier Science Comedian," Malow entertains general audiences as well as organizations such as NASA, the American Chemical Society, and the National Institute of Standards and Technology. He is a frequent participant in science festivals, a favorite at universities, and has spoken on numerous occasions at outlets of the National Academies. In addition to his stand up, Malow has produced science videos for Time Magazine and contributed to Neil deGrasse Tyson's radio show. He currently blogs for Scientific American. He has led scientist speaker training workshops for the National Science Foundation, the American Association for the Advancement of Science, and the National Research Council of Canada. Malow has appeared on The Late Late Show with Craig Ferguson and NPR's Science Friday. He's been featured in Nature, Chemical & Engineering News, the San Francisco Chronicle, the Washington Post, and the New York Times. He serves on the advisory board of the USA Science & Engineering Festival, and is a member of the National Association of Science Writers. Malow received a B.A. in Liberal Arts Honors Program, Pre-Med from University of Texas.

Meet the Museum Scientists

Jamie Smith

Jamie Smith is the Collections Manager of Invertebrates at the NC Museum of Natural Sciences. She began at the Museum 10 years ago, coming from the North Carolina Wildlife Resources Commission where she worked on crayfish. Jamie's research expertise includes cartography, programming, and malacology. However, she is a farmer at heart! Born and raised on a farm, Jamie realized her love of animals at an early age; her father encouraged Jamie's love and respect for nature by teaching her about the animals in North Carolina, exploring natural areas with her, and allowing her to work with biologists of all facets. Jamie received her Bachelors of Science degree in Marine Biology from East Carolina University. Her current work at the Museum focuses on the ecology, biodiversity, and conservation of invertebrates (particularly mollusks). Jamie's research specifically focuses on the use of molecular and morphological systematic techniques to identify mollusks, document their distribution, record their natural history, and inform conservation decisions. The Museum's Invertebrate Collection represents a true "treasure trove" for science, with many new organisms to study; Jamie sees museums as important archives of knowledge that will allow future generations to better understand their place in nature and natural history. Jamie currently serves on the Freshwater Mollusk Conservation Society's National Freshwater Gastropod and Bivalve committees.

Rachel L. Smith, Ph.D.

Dr. Rachel Smith is the Director of the Astronomy & Space Observation Research Laboratory, and an Assistant Professor in the Department of Physics & Astronomy at Appalachian State University. Rachel is an observational astronomer interested in how our solar system formed and how extrasolar systems throughout the Galaxy form and evolve. She uses large ground-based telescopes to observe the chemistry in gas surrounding forming stars outside our solar system, and compares these data to those from our Sun and meteorites to better understand how our solar system formed roughly 4.6 billion years ago. Currently, Rachel and her collaborators from the California Institute of Technology, Space Telescope Science Institute, and Jet Propulsion Laboratory are analyzing data acquired last September from Keck, and previous data from the Very Large Telescope in Chile, to explore relationships between variants of carbon monoxide (CO) in ice and gas in different types of star-forming environments. Smith also teaches astrobiology to students at Appalachian State University, works on research and outreach projects in the lab, and participates in the many exciting outreach endeavors of the Museum's Nature Research Center. Rachel received a B.S. in Evolutionary Biology from Cornell University, a D.V.M. from Cornell University, and a M.S. and Ph.D. in astrochemistry/cosmochemistry (formally, geochemistry) from UCLA.

Wayne Starnes, Ph.D.

Dr. Starnes serves in the dual roles of the Museum's Research Curator of Fishes and the Director of the Research Laboratory (a remote facility in west Raleigh that houses the "wet" Research Collections). Wayne is responsible for one of the largest and most diverse fish collections in the country. His research interests lie in documenting fish biodiversity, species distributions, biology, and conservation efforts in North Carolina and the surrounding regions. He has extensively studied and published on some worldwide marine fish families and South American freshwater groups, using multiple approaches including comparative morphology and molecular techniques. He is coauthor of a large reference book, The Fishes of Tennessee, with a similar work planned for North Carolina. Wayne often collaborates with regional agency biologists to determine the status of rare and jeopardized species and their conservation. In addition, Wayne has been active in planning and designing various Museum exhibits. He holds B.S. (Bus. Admin.), M.S. (Zoology), and Ph.D. (Ecology) degrees from the University of Tennessee, Knoxville. Wayne came to the NC Museum of Natural Sciences in 1996 after 13.5 years at the Smithsonian Institution (Washington, DC) where he worked as a technician, a post-doctoral researcher, and a research zoologist, plus serving as technical editor for the American Fisheries Society. Wayne led four Collections expeditions in the Neotropics and was project manager for a broad study of a genus of endangered fishes in the Colorado River basin. He has extensive field experience in North America, the Neotropics, Puerto Rico, Virgin Islands, Thailand, and Samoa. He has held adjunct faculty appointments at North Carolina State, George Mason, and Clemson universities, serving on graduate committees and delivering special museum based class instruction.

2013 External Funding

One of the most important, and most difficult, aspects of our scientists' jobs is to secure funding for their individual research projects. Much of the research conducted at the North Carolina Museum of Natural Sciences is externally funded through competitive grant awards from regional, state, and/or federal agencies.

Funded Grant Awards (currently active). **Names in bold font are NCSM staff.*

Beane, Jeff; $695; North Carolina Herpetological Society; An Ongoing Study of the Southern Hognose Snake (Heterodon simus) and Other Declining Reptiles in the Sandhills and Coastal Plain of North Carolina; Funded 2013-2014.

Bogan, Arthur; $12,500; North Carolina Wildlife Resources Commission; Curation of North Carolina freshwater bivalves and gastropods; Funded 2012-2013.

Cardelus, Catherine, Eliza Kent, Peter Klepies, Peter Scull, **Margaret Lowman**, and Alemayehu Wassie Eshete; $109,943; Picker Interdisciplinary Science Institute; Does religious management mitigate the socio-ecological drivers of forest change in sacred groves in northern Ethiopia?; Funded 2013-2016.

Cockman, Crystal, and **Gerwin, John**; $4,000; Land Trust for Central North Carolina; 2013 Max Mukelabi Diversity Internship Program; Funded 2013.

Cryan, Jason, and **Julie Urban**; $475,000; National Science Foundation; Illuminating the Lanternfly Tree: Phylogeny of the planthopper families Fulgoridae and Dictyopharidae (Insecta: Hemiptera: Fulgoroidea) and their bacterial endosymbionts; Funded 2010-2014.

Gates, T.A., P.M. O'Connor, and **Lindsay Zanno**; $13,052; National Geographic Society; Vertebrate paleontology of the Book Cliffs (Utah, USA); Exploring a Geographic Void; Funded 2012-2013.

Gerwin, John; $28,000; U.S. Fish and Wildlife Service; Studies of Black-throated Green and Golden-winged warblers, in the Uwharries and Nicaragua; Funded 2012-2015.

He, Zhihai, **Roland Kays**, Tony Han, Joshua Millspaugh, and Thomas Huang; $90,075; National Science Foundation; Computational and Informatics: Tools for Supporting Collaborative Wildlife Monitoring and Research; Funded 2011-2014.

Horvath-Roth, Juliann, **Julie Urban**, **Morgan Raley**, and **Bryan Stuart**; $77,659; North Carolina Biotech Center; Acquiring an Automated Pipetting system and Next-Generation DNA Sequencer to Advance Interdisciplinary Research in the Genomics and Microbiology Laboratory of the NC Museum of Natural Sciences Nature Research Center; Funded 2013.

Kays, Roland, Zhihai He, Joshua Millspaugh, William McShea, and Robert Costello; $836,943; National Science Foundation; Citizen Science Camera Trapping; Funded 2011-2014.

Gohrer, G., and **Roland Kays**; $89,936; NASA Roses Climate change; Discovering relationships between climate and animal migration with new tools for linking animal movement tracks with weather and land surface data; Funded 2011-2014.

Lowman, Margaret, **Roland Kays**, and **Michelle Trautwein**; $130,000; U.S. Forest Service; North Carolina Museum of Natural Sciences grant; Funded; 2012-2013.

McShea, William, **Roland Kays**, Robert Costello, Thornton Staples, Beth Stern, Tavis Forrester, and Patrick Jansen; $80,000; Smithsonian Grand Challenges Award; Camera trap images as mammal specimens: "Emammal" as a central repository for scientists, conservationists, and the general public; Funded 2013.

Miller, William R., E. McCord, and **Margaret Lowman**; $175,946; National Science Foundation, DBI-BIO; REU Airw: 3D Invertebrate Herbivory and Biodiversity in Deciduous North American Forest Canopies; Inspiring Students with Physical Disabilities to Pursue Field Biology; Funded 2012-2015.

Smith, Rachel L; $22,855; North Carolina NASA Space Grant; Investigating solar system evolution using high-resolution spectroscopy and radiative transfer modeling; Funded 2012-2013.

Starnes, Wayne; $20,000; Virginia Department of Game and Inland Fish; Status Survey for the rare Bridle Shiner (Notropis bifrenatus) in Virginia; Funded 2010-2014.

2013 External Funding *continued*

Stuart, Bryan, and David Beamer; $25,140; National Science Foundation; Research Opportunity Award (ROA) Supplement to Biological Inventory of the Amphibians and Reptiles of Laos; Funded 2013-2014.

Stuart, Bryan; $376,860.00; National Science Foundation; Biodiversity: Discovery & Analysis Program; Funded 2012-2015.

Trautwein, Michelle, and Brian Wiegmann; $600,000; National Science Foundation; Beyond Drosophila: Comparative transcriptomics of schizophoran flies to resolve a rapid radiation; Funded 2013-2015.

Wray, Gregory, and **Julie Horvath**; $1,624,825; NSF-BCS-08-27552; Genetic bases for the Evolution of Human Diet; Funded 2008-2013.

Submitted/Pending Grant Proposals. Names in bold font are NCSM staff.

Bogan, Arthur, and **Morgan Raley**; $26,500; U.S. Fish and Wildlife Service, Raleigh, N.C.; Proposal to determine the genetic diversity of the Dwarf Wedgemussel (Alasmidonta heterodon) in North Carolina; Submitted.

Bogan, Arthur and A. Burdett. $33,355. Proposal to the US Fish and Wildlife Service to move a mollusk collection from Albuquerque, New Mexico to Raleigh, North Carolina. Submitted 28 March 2013. Submitted.

Button, K., and **Lindsay Zanno**; $121,500; NSF Graduate Research Fellowship Program; The Ecomorphology of Beaks in Extant and Extinct Theropod Dinosaurs; Submitted.

Cardelus, Catherine, Eliza Kent, Peter Kepeis, **Margaret Lowman**, and Peter Scull; $284,694; National Science Foundation: DEB-DYN Coupled Natural-Human; CNH-Ex: Does religious management supersede the socio-ecological drivers of forest change in sacred groves of northern Ethiopia?; Submitted.

Drymala, S., and **Lindsay Zanno**; $121,500; NSF Graduate Research Fellowship Program; Evolution and Biogeography of Basal Paracrocodylmorphs from the Triassic; Submitted.

Dunn, Rob, **Margaret Lowman**, Jenifer O Corn, Angela B. Duncan, Ashlie Thompson; $7,764,481; NSF – Math & Science Partnerships; Students Discover: Improving Middle School STEM Outcomes through Scaling Citizen Science Projects; Submitted.

Edgerton, Janet, **Wayne Starnes**, and **Gabriela Hogue**; $92,684; Institute of Museum and Library Services; Research Lab Library Expansion and Engagement; Submitted.

Han, Jiawei, and **Roland Kays**; $299,212; National Science Foundation; Mining Sophisticated Movements in Dynamic Environments; Submitted.

Horvath-Roth, **Juliann**, and **Dan Dombrowski**; $150,000; Institute of Museum and Library Services; Friends of the North Carolina Museum of Natural Sciences' Proposal to Enhance the visitor Experience at the Nature Research Center; Pending.

Kandros, Kimberly and **Rachel L. Smith;** $1,108,584.48; NASA; Friends of the North Carolina Museum of Natural Sciences Proposal to Establish an Expanded and Permanent NASA Presence. Submitted.

Karraker, Nancy, **Bryan Stuart**, and William Buffum; National Science Foundation; Roles of Turtles in Stream and Forest Ecosystems and the Consequences of Population Declines; Submitted.

Kays, Roland; $1,200,000 ($300,000 for MNS); National Science Foundation; Detecting patterns in animal moving data; Submitted.

Kays, Roland; $300,000; NASA; Modeling animal distributions from remote sensing and camera trap data; Pending.

Kays, Roland, Gil Bohrer, William McShea, Robert Costello, Joshua Millspaugh, and Robert Montgomery; $75,000; NASA ROSES Management Decision Making; Modeling animal distributions from remote sensing and camera trap data; Submitted.

Klunzinger, Michael, and **Arthur Bogan**; $405,000; Australian Biological Resources Study, Department of Sustainabilty, Environment, Water, Population and Communities. Canbera, Australia; A taxonomic and phylogenetic re-evaluation of the Australasian freshwater mussels (Bivalvia: Hyriidae) using integrated morphological and molecular methods; Submitted.

2013 External Funding *continued*

Roth, Juliann Horvath, **Christy Flint**, **Morgan Raley**, **Bryan Stuart**, and **Julie Urban**; $252,350; National Science Foundation, Major Research Instrumentation Panel; MRI: Acquisition of a next-generation sequencing instrument for interdisciplinary research, training and public outreach in the NC Museum of Natural; Submitted.

Reynolds, Travis W., and **Margaret Lowman**; $321,945; National Science Foundation, SMA-RSCH; REU Site: Undergraduate Research into the Cultural, Economic and Ecological Significance of Church Forests in South Gondor, Ethiopia; Submitted.

Robinson, Walter, Margaret Blanchard, **Margaret Lowman**, Brian Reich, Peter Thorne; $5,321,282; National Science Foundation, DUE-Climate Change Education; Partnership for Data-driven Climate Change Education; Submitted.

Skene, Pate, and **Julie Horvath**; $2,500,000; NIH/NIMH; Publicly accessible genomic map for a macque model of neuropsychiatric disorders; Pending.

Stuart, Bryan, **Michelle Trautwein**, and Peter Narins; National Science Foundation; Systematics of the Smelly Frogs (genus Odorrana), a Cryptic Radiation of Amphibians in Southeast Asia; Submitted.

Stuart, Bryan (with collaborative proposals at four other institutions); $117,037; National Science Foundation, Macrosystem Biology Program; A Multifactor Evaluation of Factors Driving Diversification of Southeast Asian Terrestrial Vertebrates; Submitted.

Urban, Julie, and Charles Bartlett; National Science Foundation; pre-proposal Systematic Biology; Tracking Endosymbiont Loss and Replacement: Reconstructing Coevolutionary Relationships of Delphacid Planthoppers (Fulgoroidea: Delphacidae) with Multiple Bacterial Endosymbionts and a Yeast-Like Endosymbiont; Submitted.

Urban, Julie, **Jason Cryan**, and Charles Bartlett; National Science Foundation, Systematic Biology; Higher level phylogeny of the planthoppers (Fulgoroidea), and their coevolution with multiple endosymbionts; Submitted.and Interactions, London: John Wiley & Sons.